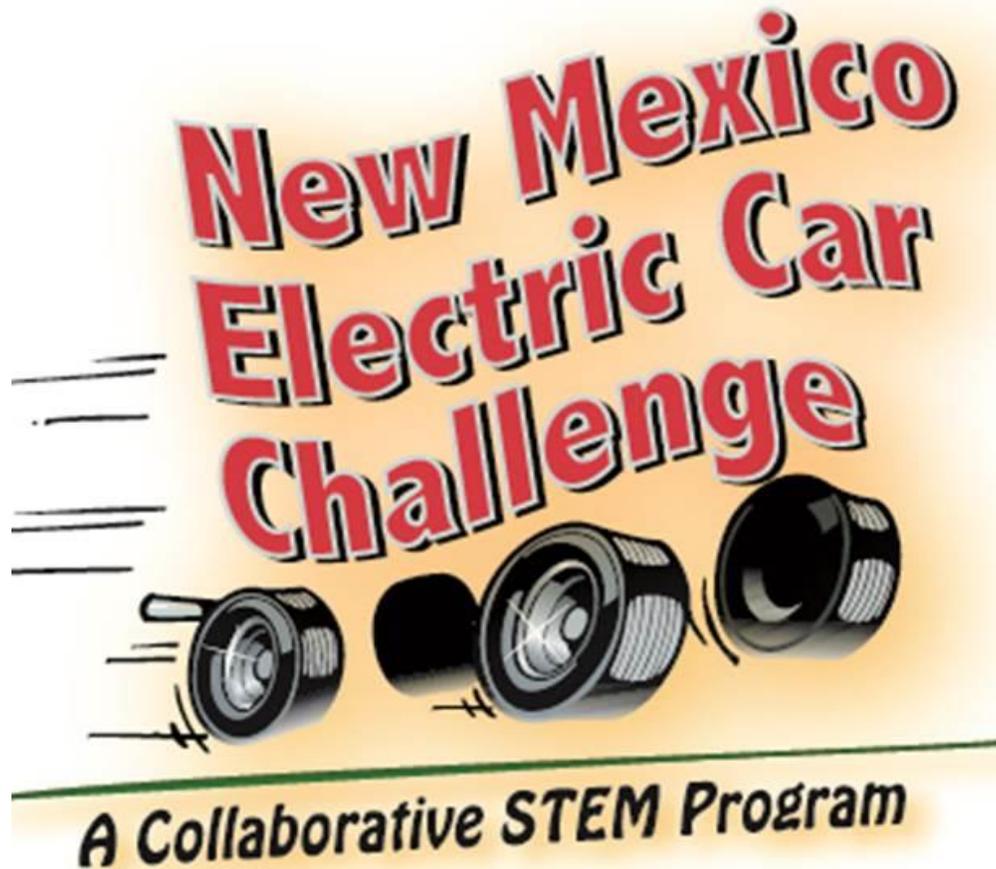


# New Mexico Electric Car Challenge 2019



## Guidelines

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# New Mexico Electric Car Challenge 2019

## Note: Changes for 2019 Are Highlighted in Green

**NOTE: This is the second year using the new power source as well as modifications to the suggested physical design.** This is both for safety as well as the durability of the constructed car. Of course, all can be modified, except the motor and battery pack/switch module. Wiring is simplified but soldering is HIGHLY recommended!

Hands-on design and application has a different feel from textbook problem solving or even traditional science labs. There is no single correct answer, any number of solutions developed by students can work. Students are excited about generating ideas in a group and then applying, building and modifying projects. They can see for themselves how changes in their design / project reflects in performance. The role of the teachers / coaches is to nurture the spirit of excitement, joy of discovery and learning that awaits students in the quest of knowledge.

### Goals of the program:

- Present science concepts in a fun and exciting way.
- Create and develop teamwork and team-building skills.
- Stimulate creative thinking through a hands-on design project.
- Challenge students in their writing capabilities.
- Help develop and enhance oral presentation skills.

## 2019 Guidelines

The New Mexico Electric Car Challenge provides an opportunity for 6th, 7th and 8th grade students to form a school team to develop and use applied science and engineering skills and face technical challenges comparable to those that scientists and engineers face every day. The Challenge was developed to provide a hands-on opportunity for students to understand the need for renewable energy sources and explore the emerging technology of electric vehicles. In addition to understanding how things work, engineers and scientists must think creatively and be able to communicate their findings. New Mexico 6th, 7th and 8th grade students are invited to participate and meet the challenges of the three-part competition.

## 2019 NM Electric Car Challenge

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### Team Guidelines:

1. Teams consist of 2-6 students from 6th, 7th and or 8th grade.
2. Students in grades 6th, 7th and 8th are eligible to participate.
3. Students may elect to work on different challenges (construction, design, and oral presentation) – all team members do not have to work on each challenge.
4. A teacher or coach from the participating school must attend the Electric Car Challenge with the student team(s).
5. Each school may have a maximum of 3 teams – each team must have an adult coach.
6. A maximum of 50 teams will be allowed to participate.

### The NM Electric Car Challenge is a three-part challenge consisting of:

**Car Design Challenge** – challenge based on innovation (system design), technology (power-train/chassis), craftsmanship and appearance (10-minute presentation).

**Car Race Challenge** – challenge based on maximum of 5 qualifying runs over a 10-meter course.

**Oral Presentation Challenge (optional)** – challenge based on an oral presentation addressing (10-minute presentation).

"Hybrid vehicles use a gasoline engine and electric motor to power the vehicle. What are the advantages and disadvantages of hybrid cars compared to electric cars?"

Each Challenge is scored individually, and awards will be provided to the top three teams for each Challenge. In addition, scores for all Challenges will be totaled to determine the top three Overall winners. Participation in the optional challenge earns points towards the Overall winners.

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### Car Specifications and Design Rules:

1. Each team is responsible for designing and building an AA alkaline battery powered model racecar.
2. All entered vehicles must be safe for contestants and spectators (e.g. no sharp edges, projectiles, etc.)
3. The dimensions of the car cannot exceed:
  - a. 20 cm in width (7.87 in.)
  - b. 40 cm in length (15.75 in.)
  - c. 20 cm in height (7.87 in.)
4. The DC motor and AA Alkaline batteries provided must be used in the design – the battery holder and motor may **not** be modified in any way.
5. The switch on the battery module **MUST** be used and the module mounted so that the switch moves “side-to-side” or “up and down” when mounted. The switch may be engaged with the car flat on the track, but it is recommended the car be lifted

## 2019 NM Electric Car Challenge

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at the back (assuming rear wheel drive) and the car released by dropping the rear while the motor is on and at full speed. The car CANNOT be pushed!

6. The vehicle must be designed to carry a payload of 1 full cylindrical salt container: height: 13.5 cm, diameter of 8.3 cm and mass of 737g (+ or – 1%).
7. The salt container may not be part of the vehicle's structure and must be easily and rapidly removed or reinserted. The following materials are examples of items you can use to hold the salt container on the chassis: cardboard, rubber bands, string, cable ties, structured compartment, etc.
8. Tape or any other adhesive cannot be used to secure the salt container.
9. The salt container will be supplied before the race and must remain unaltered. Salt containers will be reused for each race.
10. Each team provides the parts needed for the construction of the car – wheels, car body/chasses, axles, gears, etc. The motor and battery pack are required!
11. All cars will be inspected and qualified by a race official prior to the race. They must meet all vehicle specifications and will be given an inspection sticker placed on the car in a 3x3 cm space left free on each side for the official vehicle inspection sticker This must remain visible.
12. Individual decals may be affixed, and the body may be decorated at the team's discretion. The car must remain intact (except for the salt container) for the entire competition – including Design. No body parts can be removed or altered between the Design and Race Challenges.

**Steering:** A wire guide must be attached to the bottom front of the car. Two spiral guides have been provided. Only ONE should be attached at the front end of the vehicle. A guide wire, 1 cm. (+/- .5 cm) from the surface of the track, will go through the attached eyelets on the car, serving as the steering mechanism, and keeping the car in its lane. The guide wire will pass through the spiral guide to keep your car in its lane. The wire is set into the guide and moved in a spiral motion to lock the car on the wire. A similar movement in the opposite direction will detach the guide from the wire after it travels across the track. Two guides are NOT recommended!

The vehicle must be easily removed from the guide wire, without disconnecting the guide wire. This is the only allowable method of steering the car. Lane changing or crossing during the race will result in Did Not Finish (DNF).

**Tip:** *Not tracking the wire is the biggest reason some cars do not win. Setting the car down straight isn't enough. Consider this carefully in your planning and design. If the car cannot travel relatively straight without a wire, significant energy will be lost keeping the car on-track!*

### **Energy Source Specifications:**

The only energy source permitted on the vehicle is the **AA battery pack**. Failure to meet these expectations will result in disqualification. To level the playing field, the competition will provide all the fresh batteries for the final elimination rounds! You cannot use your own.

# 2019 NM Electric Car Challenge

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## Race Challenge Guidelines:

### Track Specifications:

Lane Length: 10 meters  
Lane Width: 50 centimeters per lane

### Track Surface:

Race surface will be on a rubber pad that is indoors. A guide wire will be located in the center of each lane of the track and will not be more than **1.5 cm** above the track surface.

### Race Challenge Procedure:

The time trial phase is made up of all registered competing teams and teams will be assigned to a racing group at registration. The race event will use preliminary time trials before progressing to a single elimination tournament for the finals. Each team will have the opportunity of 5-time trials to achieve their fastest times. *The fastest time in any of the 5 qualifying runs is used to determine the fastest teams.* The 8 teams with the fastest times will progress to the single elimination tournament for final run off. In the event of ties, the next fastest time from one of the 5 qualifying runs will be used to qualify for the single elimination competition.

### Pit Stop – aka - Repair/Charging Station:

Teams should bring two or more new AA battery sets to the competition. Fresh battery sets will be provided by the competition for the final elimination rounds to even the playing field. They **MUST** be used. Teams are responsible for bringing their own supplies for possible repairs or adjustments to their vehicle. A triage table will be set for limited troubleshooting.

### Qualifying Race Procedure:

1. Teams must get their 5 qualifying runs in during the time set for the “Group” their team is in.
2. When a team is ready for a “Qualifying Run” they will report to a race official at one of the race tracks.
3. Cars must race as presented/judged in the Design Phase of the competition, i.e. any additional modifications presented in Design Phase such as a “body” must be on during the races.
4. The team’s vehicle “run time” will be recorded and given to the “Race Table.”
5. A “Did Not Finish” (DNF) will be given for any of the following (Note that this counts as 1 of the 5 runs):
  - Any vehicle that does not cross the finish line within 30 seconds;
  - If the salt container falls off during a race;
  - If a car veers out of its assigned lane at any point, even if only briefly;
6. The eight teams with the fastest race times will be seeded into the Single Elimination Race Competition. The two teams eliminated in the semifinal round will race for third and fourth place points. (See Attachment C)

## 2019 NM Electric Car Challenge

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### The Starting Line (all races):

- A team must have a minimum of two members present at all times or it will be disqualified
- A team member must be positioned at each end of the lane or track. Do not move into the race areas until the race is officially over, and ONLY to retrieve your car, then exit the track promptly.
- A Judge will tell the teams to start their car, teams will lift their drive wheels off the track and flip the switch to start the motor.
- Team members may not push a vehicle to start it.  
**NOTE:** *It's recommended that the students practice releasing the car to start the race – a slight push from the student will result in the team forfeiting that run.*
- Team members may not accompany the vehicle in its lane during the race.
- Team members may not touch the vehicle until the judge has declared the race over.
- All decisions of the race officials are final.

### Single Elimination Race Competition:

- The eight fastest teams, based on the qualifying runs, compete in a timed “head-to-head” single elimination competition. Two teams race at the same time and the winner is determined by the fastest time for that race. The winner goes to the next round in the single elimination competition as shown by the bracket in Appendix C.
- In the event that both cars do not finish the race, the car that traveled the farthest will be declared the winner in the “single elimination” competition.

### Race Dispute Procedure:

1. All disputes must be made to the Head Track Judge within one minute of the end of the challenged race.
2. All disputes must come from members of the team who actively raced during the race in question.
3. Non-racing team members, coaches, parents or anyone else may not object verbally or by signal.
4. All decisions made the Head Track Judge are final and may not be appealed.

### Car Design Challenge:

All teams are required, to compete in the Car Design Challenge. Teams will be assigned to a “group color” and will be presented to Design Judges. Judges will interview the students and inspect the cars. Scoring will be determined using the Car Design Rubric (Attachment A).

**NOTE:** *Innovation, technology and craftsmanship will all be considered.*

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### Oral Presentation Challenge:

Each team is encouraged, but not required, to compete in the Oral Presentation Challenge. The presentation topic is:

"Hybrid vehicles use a gasoline engine and electric motor to power the vehicle. What are the advantages and disadvantages of hybrid cars compared to electric cars?"

This is the chance for the teams to showcase their expertise, knowledge and talents beyond the design and performance of their car. The "live" team performance is to be 5 - 7 minutes in length and can be in any format that the team chooses. Scoring will be determined using the Oral Presentation Rubric (Attachment B). Examples below are not meant to be exclusive – students are encouraged to be creative. Examples might include a skit, poster board or trifold display, song. PowerPoint presentations and video clips may be used to enhance the presentation.

**All PowerPoint presentations/video clips must be emailed to Cheryl Garcia (cagarci@sandia.gov) by midnight, November 8, 2019.**

Upon receipt of the document, an email confirming receipt and completeness will be sent. The presentations will be loaded onto laptops prior to the morning of the event. File names must include the school and team number. This will ensure that files are operational and will avoid delays during the challenge. If the teams will not be using electric media, please bring your needed materials for the presentation.

**NOTE:** *Prepared videos or movies are **NOT ALLOWED** to substitute for a live presentation – students must present "live" in front of the judges. As a precaution, each team should also bring a copy of their electronic presentation.*

### Overall Event Winners

Points will be awarded to the top four placements in all three categories of the Challenge. Participation points will also be awarded in the optional oral competition. The three overall winners will be determined by the points earned through the scoring rubric. (Attachment D)

### Second Chance Race Challenge

The *Second Chance* race challenge is for those teams that did not qualify in the Design or Orals Challenge final or in the single elimination race competition. In this challenge, the eight fastest vehicles, meeting the above requirements, will compete in a single elimination competition taking place from 1:00 to 1:45 p.m.

### Race Day Logistics:

1. Students **MUST** meet their school's "Dress Code Standards"
2. Food can be brought to the competition. Each student and coach will receive a ticket for one lunch. Food will also be available for purchase.

## 2019 NM Electric Car Challenge

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3. An awards ceremony will follow the completion of all Challenges. All student participants will receive a personal medal for participation.
  4. Awards will be given to 1st, 2nd and 3rd place teams in each Challenge and Overall.
  5. Be prepared to store and maintain control of your model between challenges.
  6. Invite parents and friends.
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### Race Day Schedule

7:30 am - 8:30 am	Team Registration & Judge Training
8:30 am - 10:00 am	Rotation Group Color 1
10:00 am - 11:30 am	Rotation Group Color 2
11:30 am - 1:00 pm	Rotation Group Color 3
1:00 pm - 1:45 pm	Design Challenge & Oral Presentation Challenge Finals <i>Second Chance</i> 8 team, single elimination “Head to Head” race contest
1:45 pm - 2:45 pm	8 team, single elimination “Head to Head” Race Final Rounds
2:45 pm - 3:00 pm	Final calculations to determine Overall Winners in all categories
3:00 pm - 3:30 pm	Awards Ceremony

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### Contacts:

Cheryl Garcia	(505) 284-5202	cagarci@sandia.gov
Janelle Vigil-Maestas	(505) 665-4329	vigil-m@lanl.gov

## Attachment A Design Challenge Scoring

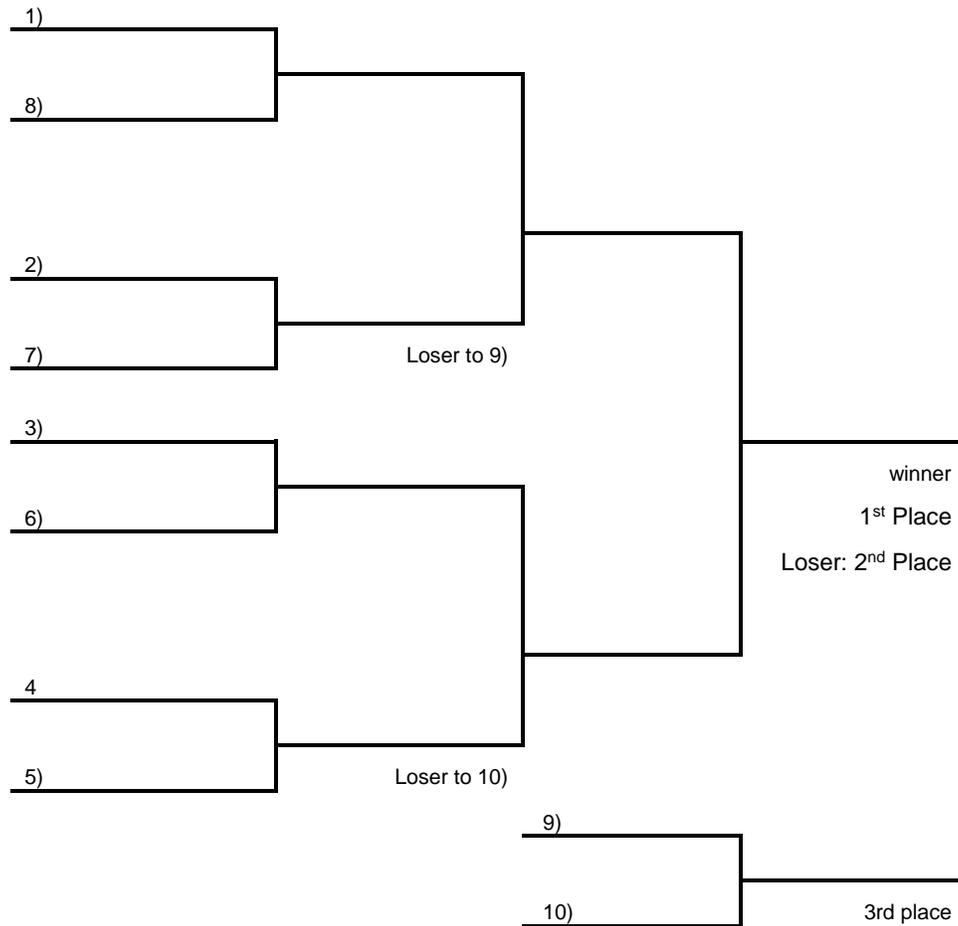
	<p style="text-align: center;"><b>Basic 1</b></p>	<p style="text-align: center;"><b>2</b></p>	<p style="text-align: center;"><b>Intermediate 3</b></p>	<p style="text-align: center;"><b>4</b></p>	<p style="text-align: center;"><b>Advanced 5</b></p>
<p><b>Chassis</b></p>	<p>Incorporates basic design components of chassis</p>		<p>Incorporates moderate level of sophistication into chassis design</p>		<p>Incorporates high level of sophistication into chassis design and mounting of equipment</p>
<p><b>Body</b></p>	<p>Very little in body design and creativity</p>		<p>Incorporates moderate level of sophistication &amp; functionality in body design &amp; application; draws a second look</p>		<p>Incorporates high level of sophistication and functionality, aerodynamics into body design</p>
<p><b>Creativity/ Aesthetics</b></p>	<p>Very little in body creativity (basic paint &amp; attachment)</p>		<p>Some creativity used in the design (unique painting, more interesting than basic design)</p>		<p>Very creative design that also enhance the performance of the vehicle (great aesthetic value; attracts attention)</p>
<p><b>Drive Train Transmission &amp; Gear Application</b></p>	<p>Uses transmission &amp; gears supplied in kit with basic wheels &amp; tires</p>		<p>Uses kit transmission &amp; gears with modifications; better wheels &amp; tires</p>		<p>Enhanced modifications to transmission &amp; gears to increase torque &amp; speed; enhance wheels &amp; tires</p>
<p><b>Construction Quality</b></p>	<p>Basic construction &amp; materials used; little more than basic kit</p>		<p>Moderate attempt to improve overall construction quality with adherence to detail</p>		<p>Very high quality &amp; detail in construction; well thought out &amp; applied</p>
<p><b>Overall Design</b></p>	<p>Very little modification to basic kit; simple &amp; effective overall design</p>		<p>More advanced design concept with some modifications; creative; good overall design</p>		<p>Extensive modifications demonstrating an understanding of engineering &amp; physics in the design</p>
<p><b>Response Skills</b></p>	<p>Missing some ideas of the project development &amp; application; lacks eye contact; hesitating in response</p>		<p>Has the main idea and effective in sharing the concept; good eye contact; speaks clearly with confidence</p>		<p>Thorough in concept of the project &amp; able to express it very well; good eye contact; speaks very confidently</p>

## Attachment B Oral Presentation Challenge Scoring

	<b>Basic 1</b>	<b>2</b>	<b>Intermediate 3</b>	<b>4</b>	<b>Advanced 5</b>
<b>Informative</b>	Missing some main ideas, inaccurate information		Captures main ideas, mostly accurate		Captures main ideas, thorough, accurate, provides good examples, and insightful
<b>Professional Attitude</b>	Often slouches, sways, turns back on audience frequently, fidgets frequently, hard to hear rare eye contact		Sometimes slouches, sways, sometimes turns back on audience, fidgets, volume too low at times, some eye contact		Stands straight, faces audience, words pronounced and heard clearly, good eye contact
<b>Organization</b>	Information not presented in a logical, interesting sequence; the audience could not follow		Information was interesting but not presented in a logical order; audience had difficulty following		Information presented in a logical, interesting sequence which the audience could follow
<b>Visual Aides</b>	Utilized less than two different types of media; information not relevant to outcome/content; messy; minimal artistic effort		Utilized two different types of media, information relevant to outcomes/content; messy; adequate artistic effort		Utilized more than two different types of media; information relevant to outcomes/content; very neat; excellent artistic effort
<b>Time/Flow</b>	Used significantly less or more than allotted time; time punctuated with many pauses and “bridges”		Used less or more than allotted time; time punctuated with some pauses and “bridges”		Used allotted time efficiently; utilized very few pauses and “bridging”
<p><b>Topic:</b>                      "Hybrid vehicles use a gasoline engine and electric motor to power the vehicle. What are the advantages and disadvantages of hybrid cars compared to electric cars?"</p>					

## Attachment C

### 8 Team Single Elimination Bracket



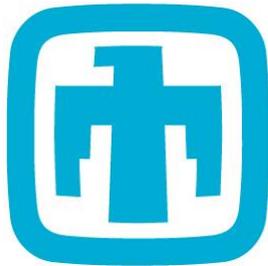
## Attachment D

### Overall Scoring Rubric

	FIRST	SECOND	THIRD	FOURTH	PARTICIPATION
RACE	70	55	40	25	
DESIGN	50	40	30	20	
ORAL	40	30	20	10	5

## Sponsors of the 2019 NM Electric Car Challenge

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